

ADHESION MARKS ON THE ABDOMEN OF PUPAL CHIRONOMIDAE (DIPTERA)

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Smooth patches on the abdominal tergites and sternites (Fig. 1) of chironomid pupae have been called 'Fensterflecken' ('window marks') (Thienemann, 1944), and, more recently, 'Muskemale' ('muscle marks') (Hirvenoja, 1973). Sæther (1980), in his glossary of chironomid morphology terminology favours the term muscle marks. However, Dr M. Hirvenoja informs me that these are inaccurately called 'Muskemale', and suggests a return to 'Fensterflecken', thereby prompting the following investigation.

MATERIAL AND METHODS

Pupae and fourth instar larvae of *Chironomus annularius* auctt. were collected from a rain-water butt. Larvae showing different stages of pupal development within them were selected and killed in either 70% isopropanol or Bouin's solution (picric-formol-acetic). They were then cut longitudinally (either vertically or horizontally), or transversely. Some of the preparations were transferred to orcein acetic, until the musculature was stained reddish-purple. The pupae were prepared for examination in the same way. All the specimens were examined under the microscope in 70% isopropanol; the more revealing examples were further dehydrated in 100% isopropanol and slide-mounted in Euparal.

OBSERVATIONS

The lateral band of dorsoventral muscles in each abdominal segment of the pupa is attached to the cuticle beneath the lateral marks of tergum and sternum, but

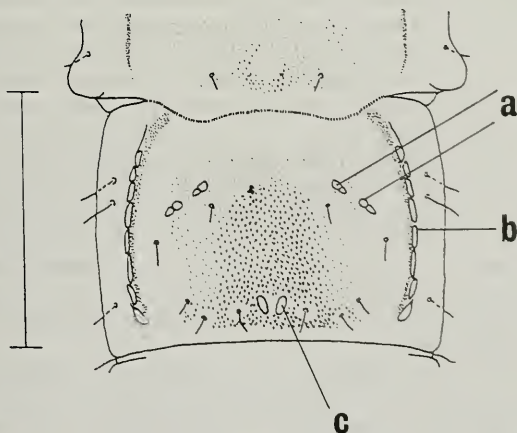


Fig. 1. Segment III, dorsal view, of the pupal abdomen of *Chironomus annularius*. a: anterior adhesion marks; b: row of lateral adhesion marks; c: posterior adhesion marks. Scale line 1 mm.

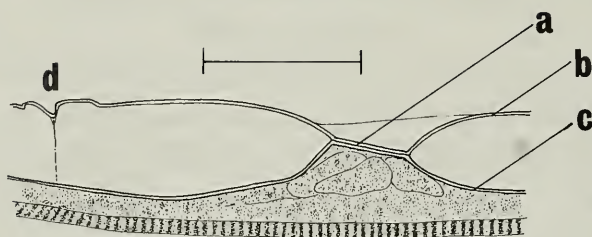


Fig. 2. Posterior adhesion point in late fourth instar larva of *Chironomus annularius*. a: adhesion point between larval and pupal cuticles; b: larval cuticle; c: pupal cuticle; d: posterior margin of abdominal segment V. Scale line 0.1 mm.

there are no muscle attachments to the cuticle beneath the anterior and posterior marks.

In late fourth-instar larvae, the nearly fully formed pupal cuticle remains attached to the otherwise apolysed larval cuticle at all the points that remain smooth upon ecdysis (Fig. 2). At this stage the larva is still feeding, and its movements are still larval: it crawls using its anterior and posterior parapods, and remains capable of curling into a spiral when disturbed. Shortly before ecdysis, the lateral adhesion points are seen to be separated from the larval cuticle. The separation of the cuticles at the anterior and posterior marks occurs later, upon ecdysis.

DISCUSSION

The late fourth-instar chironomid larva is a complex animal. In *Chironomus* the pupal head (and the developing adult head within it) forms in the anterior thorax of the larva (Miall & Hammond, 1900). (In many other chironomids the pupal head develops partly in the posterior part of the larval head and partly in the anterior thorax.) Apolysis of the larval cuticle is progressive, beginning at the developing wing and leg sheaths, subsequently spreading around the thorax and along the abdomen. Even when the pupa is nearly fully apolysed and adult features can be seen within it, the animal is still behaving as a larva and continues to feed. Final preparation for ecdysis is very rapid. Extensions into the larval head and parapods are withdrawn. The pupal abdomen becomes dorsoventrally flattened, presumably by the contraction of the lateral dorsoventral muscle bands. At the same time the pupal cuticle comes away from the larval cuticle at the lateral adhesion points. Movements now are the dorsoventral undulations characteristic of the pupa, which serve to drive the pupa forwards in the larval cuticle and out through the split dorsal suture of the larval thorax. During this process the pupal and larval cuticles pull apart at the anterior and posterior adhesion points.

The adhesion points between the pupal and larval cuticles enable the larva to transmit its movements to the substratum from musculature now enclosed within the pupal cuticle. The time between the cessation of larval feeding and the emergence of the imago is thus greatly reduced, for the adult is already nearly fully formed when the pupa leaves the larval exuviae. (In *Paratanytarsus grimmii* Schneider imaginal eclosion may take place only 25 minutes after pupal ecdysis (Krüger, 1941).)

The smooth areas on the abdomen of pupal Chironomidae, previously called Fensterflecken or Muskelmale/muscle marks are more accurately termed adhesion marks.

ACKNOWLEDGEMENT

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BENHS FIELD MEETING

Oakers Wood, Dorset, 22 May 1993

Leader: Mick Parker. Eight members turned up for the daytime meeting, followed by seven for the moth trapping session. Conditions were cloudy, slightly damp, but warm and as a result, it was decided to work the outskirts of the main locality, heading north through mixed woodland, west through wet heath, up on to dry heath, then south into the main oak wood which by this time had dried out.

Thirteen species of sawfly were noted plus a small number of other hymenoptera of which *Vespa crabro* (L.) was the most obvious. The hoverfly list was rather better with 23 species, including the RDB 1 species *Chrysotoxum vernale* (Leow), caught sitting on bracken. Other uncommon species were: *Brachypalus laphiformis* (Fall.), *Brachyopa scutellaris* (R.-D.) and *Criorhina asilica* (Fall.), all on *Crataegus monogyna* L. flowers and *Pelecocera tricincta*, (Meig.), which was swept. None of these were new to the Oakers Wood list.

The evening session produced five moth traps. The evening was warm with frequent showers. A total of 59 macros and 6 micros were recorded of which the most notable were: marbled pug (*Eupithecia irriguata* Hübn), ringed carpet (*Cleora cinctaria* D. & S.) and the little thorn (*Cepphis advenaria* Hübn). As the evening wore on the showers became heavier and we were worried that some M.V. bulbs might start exploding—one did, mine! As I forgot to pack a spare, my collecting ceased about midnight. Most of the moth records are due to the rest of the group, and to them I am grateful. Thanks are also due to Mr John Shelly of Oakers Wood House for permission to hold the field meeting.